STAR-LITE 1.0
Safe Techniques Advance Science – Laboratory Interactive Training Experience

Instructional Guide
April 2009

STAR-LITE 1.0 Instructional Guide
Table of Contents

Training Overview

STAR-LITE (Safe Techniques Advance Research – Laboratory Interactive Training Environment) is a computer-based training experience designed to teach laboratory safety and risk assessment techniques to high school and undergraduate students. The instruction takes place in an engaging, interactive, virtual laboratory setting that allows users to practice making safe decisions through participation in consequence-driven quests.

STAR-LITE is developed for high school and undergraduate students, ages 16 through 21, as a supplement to existing laboratory safety training offered in classrooms. STAR-LITE is not required as part of any curriculum standards. Yet, the laboratory safety and risk assessment techniques presented in this training will assist teachers in meeting the National Science Education Standards[1], including "Science as Inquiry" and "Science in Personal and Social Perspectives." STAR-LITE is not designed to teach scientific concepts and theories nor is it designed to meet regional curriculum expectations.

Students do not need any prior laboratory safety knowledge to successfully complete STAR-LITE. Once the software has been downloaded and installed on a computer, the student can interact with the training for an individualized experience. Students should be encouraged to use the training inside and outside the classroom. We encourage students to revisit this training throughout the academic year.

[1]National Academy of Sciences. 1996. National Science Education Standards. National Academy Press. Washington DC.

System Requirements

To maximize the STAR-LITE educational experience, the training should be operated on a computer that meets the following recommended requirements:

Recommended Requirements, Windows System:
- Operating System: Microsoft Windows 2000 or higher (XP, Vista)
- CPU: Intel Pentium 4, or equivalent
- Memory (RAM): 1GB+ (Windows 2000/XP)
- Free Hard Drive Space: 1GB
- Screen Resolution: 1024 x 768
- Color Depth: 16-bit color display
- Video Card (RAM): 128 MB+
- Audio: Integrated sound card
- Microsoft DirectX 9.0 or higher
- Quicktime 7.0 or higher
- Computer speakers or headphones
- Standard keyboard
- Standard two-button mouse
- Internet Connection: High-speed (for download only)

Recommended Requirements, Macintosh System:
- Operating System: Mac OS 10.4 or higher
- CPU: 2.16GHz PowerPC G4/G5 processor or Intel Core Duo processor
- Memory: 1GB
- Free Hard Drive Space: 1GB
- Screen Resolution: 1024 x 768
- Color Depth: 16-bit color display
- Video Card (RAM): 128 MB+
- Quicktime 7.0 or higher
- Computer speakers or headphones
- Standard keyboard
- Standard two-button mouse
- Internet Connection: High-speed (for download only)

Please consult with your Information Technology Department or Representative for assistance with the recommended requirements.

Introduction to this Guide

This Instructional Guide is designed for science educators who plan to integrate STAR-LITE into their existing science curriculum.

STAR-LITE is an educational computer-based training about laboratory safety. The content of this training is designed for students 16 through 21 years of age.

The student user is expected to create an individualized character that is then self-directed through a virtual environment. Educational learning experiences are initiated in the environment by characters who issue tasks to the student. The learning experiences teach the student about potential biological, chemical, and physical hazards that may be present in laboratories. Each task that is assigned to the student incorporates laboratory safety instruction and risk assessment strategies.

The ultimate goal of STAR-LITE is to reduce the number and severity of hazardous incidents that occur in the academic laboratory setting. Incorporating laboratory safety knowledge and risk assessment techniques early in a student's science education increases the likelihood that safety will be ingrained in their culture as they advance through academia into their profession of choice.

We encourage educators to incorporate laboratory safety into each science class on a routine basis.

Learning Objectives

By completing STAR-LITE, students will gain direct knowledge on the following:

- Safe laboratory techniques;
- Risk assessment techniques;
- Potential biological, chemical, and physical hazards that may be present in laboratories;
- Methods to prevent injuries in the laboratory;
- Methods to protect students, colleagues, and the environment from potential hazards in the laboratory; and
- Emergency preparedness and response basics.

Quest Lesson Plans

STAR-LITE comprises 15 learning experiences that are called Quests. The following Lesson Plans have been developed for use by educators implementing STAR-LITE in the classroom.

The 15 Quests are:

1. Laboratory 101
    a. Avatar Creator
    b. Welcome to the Lab
    c. Bad Behavior Museum
    d. Meet your Colleagues
    e. Meet the Thinkers
2. Get A Clue Scavenger Hunt
3. BioBubble
4. Vapor Caper
5. Cuts & Guts
6. Burn It Down
7. Save Your Hide
8. Waste Without Haste, Petri Dish Disposal
9. Find It, Fix It
10. Waste Without Haste, Needle Disposal
11. Blow It Up
12. Blender Bender
13. Boxing Chemicals
14. Waste Without Haste, Acid Disposal
15. Slip Sliding Away

Quest Title	**Laboratory 101: Avatar Creator**
Mission	Create an individualized, appropriately dressed character that the student user will navigate through the virtual laboratory environment.
Lesson Objectives	After completing Avatar Creator, the student user will have knowledge of the following: • Clothing, shoes, hairstyles, and accessories appropriate for a day of work in the lab.
Before the Lesson	Brainstorm Session What is appropriate "dress" for a day in the lab? Think about clothes, shoes, hair, and accessories like hats and jewelry.
Lesson Activity	Create an individualized character, or avatar. Students can select the name for their character and its gender in the Character Menu. Then, they can peruse the body, clothing, accessories, and body art tabs in the Avatar Creator to create an individualized character who is appropriately dressed for a day in the lab. Appropriate dress in this case means that the item does not interfere with safe laboratory research. For example, long hair, open-toed shoes, and dangling jewelry pose their own safety hazards when working in the lab. We want the student to learn what is and is not appropriate for the laboratory not because we're sticklers for fashion, but because certain items may be unsafe and may result in potential harm. Please note: Personal protective equipment, like a lab coat, gloves, and protective eyewear will be selected later in the training. For now, the goal is to learn about being prepared for a day in the lab. Should an inappropriate clothing, hair, shoe, or accessory be selected, the student user will receive a message on the screen that indicates the problem. They will not be able to progress out of the Avatar Creator until appropriate options are selected. While the goal is to dress appropriately, finding options that are not allowed is equally educational. Find at least one inappropriate item in each of the four tabs.
Discussion	Discuss how we might be exposed to potential hazards, e.g., spills, splashes, aerosol exposure, injection or puncture, and

Quest Title	Laboratory 101: Avatar Creator
	lacerations. Discuss the parts of the body that may be affected, e.g., skin, eyes, and internal organs.
Evaluation	Q: What can “go wrong” if inappropriate clothes, shoes, hair styles, or accessories are worn in the lab? A: There are a variety of answers and potential discussion points. For example, long hair should be tied back so that it does not get entangled in equipment or fall into a Bunsen burner or into a beaker containing potentially hazardous liquids. Students want to wear shoes that will protect their feet and toes from things that can fall onto their feet. Students who wear sandals or flip-flops to school should have a change of shoes ready for them when it comes time for lab work.
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 20 minutes Discussion: 15 minutes

Quest Title	**Laboratory 101: Welcome to the Lab**
Mission	Meet the Lab Manager and go on a guided tour of the laboratory suite.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Features of a multi-discipline laboratory suite; • Common safety equipment found in laboratories, including, but not limited to, chemical fume hood, biological safety cabinet, personal protective equipment, emergency eyewash and shower; • The four biosafety levels and what distinguishes the levels, e.g., laboratory practices and safety equipment.
Before the Lesson	Brainstorm Session 1. What makes a laboratory different from another type of academic setting, e.g., a classroom, playing field? 2. What are the safety issues in a laboratory versus other academic settings?
Lesson Activity	Follow Mackenzie's lead as she shows you around the laboratory suite. Read her text and follow her prompts. Explore features like the MiniMap and the ZipOut text that pops up when you right-click on highlightable items. In the Main Lab, Mackenzie asks you to identify four laboratory safety-related items: a chemical fume hood, a chemical storage cabinet, an emergency eyewash, and a safety shower. The Main Lab has two chemical fume hoods along the back wall in either corner. There is a set of under-the-counter flammable storage cabinets and corrosive storage cabinets on the first two islands nearest the main lab door. The emergency eyewash is attached to each sink faucet in the lab and the safety shower is nearest either door to the Main Lab. Signage for the shower is on the wall nearest the shower. In addition to these items, find at least two other pieces of equipment in this lab. In the Tissue Culture Laboratory, Mackenzie asks you to identify for laboratory safety-related items: a biological safety cabinet, a lab coat, eye protection, and hand protection. The Tissue Culture Laboratory has four biological safety cabinets along the side walls of the lab. Personal protective equipment in

Quest Title	Laboratory 101: Welcome to the Lab
	the form of a lab coat, gloves, and eyewear is scattered throughout the lab, but is concentrated nearest the main door to this lab. In addition to the four safety items Mackenzie asks you to find in the Tissue Culture Laboratory, identify at least one other piece of equipment in this lab. In the Equipment Room, Mackenzie asks you to find the liquid nitrogen freezers, a microwave, and an autoclave. More information about these types of laboratory equipment can be found in the Laboratory Notebook feature of the main button bar at the bottom of the screen. The liquid nitrogen freezers are in the first alcove of the Equipment Room. The microwave is in the second alcove and the autoclave is behind the door in the third alcove.
Discussion	Q: What areas of the laboratory suite are off-limits to students? A: Use the MiniMap to help you review the different areas of the lab suite. You'll see that the Rad Room, Laser Lab, and BSL-3 Lab are all off-limits. Because of the potential unique hazards of these areas, special safety training is required in order to enter and work in these labs. In addition, some work areas are off-limits based on age restrictions, for example, minors (people under the age of 18).
Evaluation	Q: A chemical fume hood is one type of laboratory equipment that provides protection to the user. Identify at least one type of laboratory equipment in the virtual lab that is not designed to protect the user or the environment from potential hazards. A: Examples of laboratory equipment in the lab that, in themselves, do not protect users or the environment from potential hazards include the centrifuge, microtome, homogenizer, sonicator, and water bath. These pieces of equipment must be used with additional protective measures. For example, a centrifuge should be used in conjunction with centrifuge safety cups that protect the user and the environment from aerosolized particles.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 30 minutes Discussion: 10 minutes

Quest Title	**Laboratory 101: Bad Behavior Museum**
Mission	Continue the laboratory suite tour. Visit the Bad Behavior Museum in the Library.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Incidents that may occur in the laboratory that can result in negative human health effects and environmental harm.
Before the Lesson	Brainstorm Session Identify unsafe behaviors for a laboratory setting. List out "What Not To Do" laboratory activities.
Lesson Activity	Mackenzie will introduce you to Bad Behavior Museum and to the star attraction: The Oafs, an unsafe group of primitive laboratory researchers. Watch each of the three Bad Behavior Museum sequences all the way through at least once.
Discussion	Q: What went wrong in the lab? List the bad behaviors demonstrated in the Bad Behavior Museum sequences. A: There are approximately 25 incidents of unsafe behaviors and practices. These include, but are not limited to: • Juggling, goofing around • Improper transport of laboratory materials • Inappropriate or no personal protective equipment • Unlabeled chemical containers • Drinking in the lab • Unchained compressed gas cylinder • Open containers • Slip hazards • Improper use of a laboratory stool • Unwanted release of a chemical • Unwanted inhalation exposure • Unwanted illness • Overloaded electrical outlets • Trip hazards • Inappropriate storage in walkways • Application of makeup in the lab • Improper chemical storage • Inappropriate clothes • Unwanted environmental exposure Discuss potential consequences of unsafe behaviors. Think about potential negative impacts on human health and the environment.
Evaluation	Compare the list of unsafe behaviors made before the Lesson Activity with the list made after the Lesson.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 20 minutes Discussion: 15 minutes

Quest Title	**Laboratory 101: Meet your Colleagues**
Mission	Continue with the tour of the laboratory suite. Meet your colleagues, the Principal Investigators who work in the labs.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Roles and responsibilities of personnel in a lab.
Before the Lesson	Brainstorm Session 1. Who are the people involved in the operation of an academic laboratory?
Lesson Activity	Mackenzie will introduce you to four Principal Investigators who work in the virtual laboratory suite. Interact with each of the four pictures to learn more about these people.
Discussion	Q: What do the four colleagues do in the lab? What are their science specialties? A: Ling is a molecular biologist. Juan is a biochemist. Sara is a research chemist and Grant is a microbiologist. Discuss the various types of scientific research in which a student could pursue as a profession. Look up each of the four titles mentioned by Ling, Juan, Sara, and Grant. Look at various university science programs, governmental institutions, and industries that involve scientific research to learn more about the various disciplines.
Evaluation	Q: Who is responsible for your safety in the lab? A: Safety is everyone's responsibility. Each student is responsible for practicing safe techniques in the laboratory. In addition, parents, teachers, school administrators, maintenance personnel…everyone is responsible for safety.
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 10 minutes Discussion: 20 minutes

Quest Title	**Laboratory 101: Meet the Thinkers**
Mission	In this final phase of the laboratory suite tour, you will learn about risk assessment techniques from the Thinkers, a team of wise laboratorians who act as the student user's safety "conscience."
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Risk assessment skills in the form of four critical thinking questions; • Three types of potential hazards present in the lab, specifically biological, chemical, and physical hazards; • How exposure to biological, chemical, and physical hazards can affect human health, specifically knowledge of routes of exposure (inhalation, ingestion, skin exposure, and injection); • Methods to prevent unsafe incidents in a laboratory, specifically exposure to training and reference materials and emergency preparedness and response specifics that educate the laboratorian; and • Methods to protect yourself, others, and the environment from unsafe exposures to hazards, specifically chemical fume hoods, biological safety cabinets, personal protective equipment, and management of potentially dangerous laboratory waste.
Before the Lesson	Brainstorm Session 1. What do they consider to be risky behaviors? 2. How do they assess risk?
Lesson Activity	Mackenzie will introduce you to the Thinkers. Interact with each of the four statues to learn more about risk assessment in the laboratory. Watch all four Thinker sequences at least once.
Discussion	Discuss the risk assessment process (the four questions) in relation to common, everyday activities (e.g., brushing your teeth), as they apply to a job (e.g., working in a restaurant or as a lifeguard), and as they apply to other academic activities (e.g., physical education or art class).
Evaluation	Q: What are the four risk assessment questions posed by the Thinkers? A: 1) What are you working with? 2) What are the potential hazards? 3) How can you prevent potential harm to yourself, others, or the environment? 4) How can you protect yourself, others, and the environment from potential hazards?

Quest Title	**Laboratory 101: Meet the Thinkers**
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 20 minutes Discussion: 20 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Risk Assessment • Biological Hazard • Chemical Hazard • Physical Hazard • Dose-Response • Routes of Exposure • Standard Operating Procedures • Engineering Controls • Personal Protective Equipment

Quest Title	Get A Clue Scavenger Hunt
Mission	Receive eight laboratory safety-related Clues from lab personnel throughout the lab suite. Use Hints provided by the Thinkers to help identify the answer to the Clue. This Quest includes review of potential biological, chemical, and physical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Common laboratory safety signs and safety symbols, including the importance of signage in communicating potential hazards; • Common equipment found in scientific research laboratories; • Material Safety Data Sheets (MSDS); and • The importance of hand washing and personal hygiene.
Before the Lesson	Discuss with the students the concept of science as inquiry. Specifically, review this statement: "Designing and conducting a scientific investigation requires introduction to the major concepts in the area being investigated, proper equipment, safety precautions, assistance with methodological problems, recommendations for use of technologies, clarification of ideas that guide the inquiry, and scientific knowledge obtained from sources other than the actual investigation."
Lesson Activity	As you progress through this Quest, make note of the eight answers to the Clues.
Discussion	Q: How did each of the eight Clues relate to the four critical thinking questions? What was the connection between each Clue and the questions? A: There are a few connections to make. For example, the Clue about the radioactive material sign implies answers to the critical thinking questions: "What am I working with?", "What are the potential hazards?" The Clue about the Biosafety Level 2 signs implies answers to all four critical thinking questions.
Evaluation	Revisit the science as inquiry discussion from Before the Lesson. Identify how the components in this Quest help to satisfy the components of the statement made in the Before the Lesson discussion.

Quest Title	Get A Clue Scavenger Hunt
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 25 minutes Discussion: 15 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Centrifuge • Radioactive Materials • Chemical Storage Cabinets • Safety Signage • Biosafety Level 2 • Corrosive Chemicals • Biosafety Level 3 • Material Safety Data Sheet • Good Laboratory Practices The statement provided in the Before the Lesson section is from the National Science Education Standards, Content Standard A.

Quest Title	BioBubble
Mission	Assist a Principal Investigator and an alien character with centrifugation of a biological sample and with preparation of the sample in a biological safety cabinet. This Quest involves potential biological hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • How to avoid aerosolization of products used in a centrifuge, including the importance of using safety cups; • How to respond to an inhalation exposure of a biological material; • How to manage a splash to the arm of biohazardous material; • How trained personnel handle a small biological spill; • Appropriate Personal Protective Equipment (PPE) to wear when working with biological materials in the lab; • Waste management techniques for biohazardous waste materials; and • Frequency of hand washing.
Before the Lesson	Review the Top 10 Questions for Emergency Preparedness and Response as identified in the Notebook. Review the answers to these questions with the students – be certain to be as specific as possible for your laboratory location. 1. What are the specific safety protocols for work in the lab? 2. Who are the emergency points of contact? 3. Where is their contact information? 4. What should I do if there is an accident in the lab? 5. What should I do if someone is injured? 6. Where is emergency response equipment located? 7. When should emergency response equipment be used? 8. Where is the closest emergency eyewash station and safety shower? 9. What are the evacuation routes for this lab and this building? 10. Where is the designated assembly place?
Lesson Activity	As you progress through this Quest, make note of the methods used to protect the student from potential harm, e.g., personal protective equipment, centrifuge safety cups, and biological safety cabinets.

Quest Title	BioBubble
Discussion	Q: What happened to the alien character? What caused the incident? What was the consequence of the incident? What could have been done to prevent this from happening? A: Eleanor Thompson (E.T.), an alien character, suffered an inhalation exposure when biological materials became aerosolized during centrifuging. She did not use safety cups and she was not wearing proper personal protective equipment during the experiment. As a consequence of this exposure, she had to visit the Medical Services office to report the accident and receive treatment. The side effect of the treatment was an obnoxious bubble syndrome. By using proper protective equipment and safe laboratory practices, she could have avoided this accident and inhalation exposure.
Evaluation	Q: What are the main differences between biological safety cabinets and chemical fume hoods? A: A biological safety cabinet, like the one used in this Quest, protects the worker, the environment, and the biological material from potential contamination and exposure by using a special type of air flow and high efficiency particulate air filters. A chemical fume hood does not filter the air inside the cabinet and instead draws air into the cabinet and up into a stack so that dangerous vapors are drawn away from personnel.
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 20 minutes Discussion: 15 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Bloodborne Pathogen • Other Potentially Infectious Material • Exposure Control Plan • Universal Precautions • Biological Safety Cabinet • Latex Gloves • Incubator • Centrifuge Safety Cup • Aerosolization • Medical Services • Decontamination • Biohazard Bag

Quest Title	**Vapor Caper**
Mission	Assist a Principal Investigator with the safe use of a flammable chemical. This Quest focuses on potential chemical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Use of Material Safety Data Sheets to provide information on safe storage and handling of chemicals; • Use of a chemical fume hood to protect personnel from exposure to chemical vapors; • Use of Personal Protective Equipment (PPE) to protect personnel from unwanted exposure to chemicals • Proper response to a chemical spill; and • Signs and symptoms of exposure to a flammable chemical.
Before the Lesson	If you have not already reviewed the emergency preparedness and response information for your laboratory, then review the Top 10 Questions for Emergency Preparedness and Response as identified in the Laboratory Notebook. Review the answers to these questions with the students – be certain to be as specific as possible for your laboratory location. 1. What are the specific safety protocols for work in the lab? 2. Who are the emergency points of contact? 3. Where is their contact information? 4. What should I do if there is an accident in the lab? 5. What should I do if someone is injured? 6. Where is emergency response equipment located? 7. When should emergency response equipment be used? 8. Where is the closest emergency eyewash station and safety shower? 9. What are the evacuation routes for this lab and this building? 10. Where is the designated assembly place?
Lesson Activity	As you progress through this Quest, make note of the sequence of events leading up to the spill.
Discussion	Q: What could Blobby have done differently to prevent his exposure? A: After the chemical bottle broke, Sara should have ushered the student out of the lab and encouraged everyone to evacuate the area. Blobby would have left the lab and would have never been exposed to the flammable vapors released from the spill. After

Quest Title	Vapor Caper
	evacuating the area, Sara should have contacted trained response personnel to respond to the lab. Q: What were Blobby's signs and symptoms of exposure? A: Blobby was exposed to vapors released by a flammable chemical. He became dizzy. Review the MSDS binder in the training to review available information about other chemicals found in the virtual lab environment. Look for information about safe storage, handling and use.
Evaluation	Q: What did we learn about acetonitrile from the Material Safety Data Sheet? Think about storage and safe handling. A: In this Quest, the MSDS helped the student to identify what PPE was needed to safely work with the chemical and where the chemical was stored.
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 20 minutes Discussion: 15 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Chemical Fume Hood • Flammable Chemical • Nitrile Gloves • Laboratory Coat • Exposure Signs and Symptoms • Transport of Hazardous Materials

Quest Title	**Cuts & Guts**
Mission	Assist an alien character to properly dispose of a sharp. This Quest deals with general emergency response.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • How to respond to a puncture wound or cut experienced in the lab
Before the Lesson	If you have not already reviewed the emergency preparedness and response information for your laboratory, then review the Top 10 Questions for Emergency Preparedness and Response as identified in the Laboratory Notebook. Review the answers to these questions with the students – be certain to be as specific as possible for your laboratory location. 1. What are the specific safety protocols for work in the lab? 2. Who are the emergency points of contact? 3. Where is their contact information? 4. What should I do if there is an accident in the lab? 5. What should I do if someone is injured? 6. Where is emergency response equipment located? 7. When should emergency response equipment be used? 8. Where is the closest emergency eyewash station and safety shower? 9. What are the evacuation routes for this lab and this building? 10. Where is the designated assembly place?
Lesson Activity	Be sure to watch the first scene carefully – this is where Blobby walks into a scalpel and springs a leak.
Discussion	Identify objects in the lab that qualify as sharps.
Evaluation	Q: What should students do if they suffer a cut or a puncture wound while working in the lab? A: Notify a teacher or senior staff member and get assistance from trained medical personnel.
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional	Review and incorporate the following terms into the Discussion

Quest Title	Cuts & Guts
Resources	section. These terms can be found in the Laboratory Notebook: • Sharps

Quest Title	**Burn It Down**
Mission	Assist a Principal Investigator with safe transport of laboratory supplies. Discover a potential fire hazard in the lab. This Quest deals with general emergency response.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Hazards associated with laboratory equipment left unattended; and • Response to potential imminent danger (e.g., fire).
Before the Lesson	If you have not already reviewed the emergency preparedness and response information for your laboratory, then review the Top 10 Questions for Emergency Preparedness and Response as identified in the Laboratory Notebook. Review the answers to these questions with the students – be certain to be as specific as possible for your laboratory location. 1. What are the specific safety protocols for work in the lab? 2. Who are the emergency points of contact? 3. Where is their contact information? 4. What should I do if there is an accident in the lab? 5. What should I do if someone is injured? 6. Where is emergency response equipment located? 7. When should emergency response equipment be used? 8. Where is the closest emergency eyewash station and safety shower? 9. What are the evacuation routes for this lab and this building? 10. Where is the designated assembly place?
Lesson Activity	In this Quest, the student user can elect to let the papers next to the hotplate catch on fire, or unplug the hotplate to prevent the fire. Be sure to experience both options.
Discussion	Review the specific emergency response activities for a fire in the lab.
Evaluation	Q: What should you do if you suspect a fire hazard may be present? A: Report the suspected hazard to a teacher or supervisor immediately.
Estimated	Before the Lesson: 10 minutes

Quest Title	**Burn It Down**
Maximum Time to Complete	Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Emergency Preparedness and Response Procedures

Quest Title	Save Your Hide
Mission	Answer Game Show questions related to chemical safety. This Quest covers chemical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Proper response to a chemical spill incident in the lab; • How to respond if a colleague has a medical emergency; • Recognition of safety signage; • Safe methods of chemical storage; and • Safe methods of chemical waste disposal.
Before the Lesson	Inform students that this Quest is different from the others in that it takes place in a Game Show environment and not the laboratory environment.
Lesson Activity	As students progress through this Quest, make note of how they do on the questions.
Discussion	Review emergency response techniques for the following: splash of a chemical to a person's body, face, or eyes and release of a chemical to the environment in the form of a spill or aerosolization. This Quest introduces the concept of hazardous waste, chemical waste generated in the lab that needs special treatment for disposal and cannot be disposed in the normal garbage can or down the drain. Discuss the importance of managing chemical waste as hazardous waste.
Evaluation	Review the questions asked during this Quest. Q: You see a puddle of clear liquid and a broken chemical bottle on the floor. You smell a nauseating odor, the bottle is labeled pyridine and reads, "Danger! Serious fire hazard and health hazard." What should you do? A: Leave the laboratory, report the spill to a supervisor, contact the emergency spill response team, and do not reenter the lab until the spill has been cleaned up by the trained response team. Q: Your colleague is working with ethanol in the chemical fume hood and is wearing a lab coat and goggles, but no gloves. The ethanol accidentally spills onto your colleague's hands and wrists. What should you do? A: Assist your colleague as they walk to the sink where they can

Quest Title	Save Your Hide
	wash their hands with soap and warm water and immediately report the incident to a supervisor. Q: What does this sign represent? A: Laser light. Q: What does this sign represent? A: Emergency eyewash. Q: Which one of the following statements is true? A: A chemical's material safety data sheet will provide information regarding safe storage and handling of the chemical. Q: Which one of the following statements is false? A: A chemical storage cabinet will contain all chemical vapors and odors. Q: Hazardous waste management is a minor factor in planning a laboratory experiment and can be ignored until the end of the experiment. A: False. Q: Dilution is the solution to pollution. Small quantities of hazardous waste can be disposed of in the laboratory sink as long as the sink drain is flushed for 15 minutes with water. A: False. Q: What should you do when your supervisor asks you to retrieve a chemical from a storage cabinet? A: First, read the Material Safety Data Sheet for this chemical. Second, get the proper PPE to wear when handling the chemical. Third, retrieve the chemical from the proper storage cabinet. Q: What should you do when you laboratory supervisor is not wearing PPE while working with hazardous biological materials or chemicals? A: Wear you PPE and offer some to your supervisor. Q: Which one of the following statements is true? A: Chemical storage cabinets are designed for the safe storage of a variety of hazardous chemicals.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 30 minutes Discussion: 10 minutes

Quest Title	**Save Your Hide**
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Laboratory Waste Management • Secondary Containment • Safety Symbols The U.S. Environmental Protection Agency (EPA) is an excellent resource for information regarding hazardous waste. For more information, check out : http://www.epa.gov/osw/hazwaste.htm
Quest Title	**Waste Without Haste – Petri Dish Management**
Mission	Assist an alien character to properly dispose of biohazardous waste. This Quest covers biological waste management.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Management of waste generated in a lab, specifically biohazardous waste.
Before the Lesson	Brainstorm Session List out the different types of waste that are generated in the laboratory. Be as specific as possible. An idea is to walk around the lab and determine how it would be disposed of at the end of its useful life.
Lesson Activity	Encourage students to try to dispose of the Petri dishes in different waste receptacles throughout the lab and to read the associated text messages when the incorrect waste receptacles are selected.
Discussion	This Quest helps students to become familiar with the concept that most things in the lab environment cannot be disposed of in the regular trash. Students and teachers should stop and think about everything they need to throw away – acknowledging that they may not know what the item is or where to properly dispose of it – and recognize the need to research safer disposal options.
Evaluation	Identify items in the laboratory and determine where they should be properly disposed of to minimize harm to people and the environment. Examples include everyday items (e.g., paper), laboratory equipment, and biological materials (e.g., the dissected worm from biology class).

Quest Title	Save Your Hide
Estimated Maximum Time to Complete	Before the Lesson: 10 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Laboratory Waste Management • Biohazard Bag • Burn Box • Autoclave The EPA has several publications about lab waste management. We recommend the small lab guide: http://www.epa.gov/sbo/pdfs/smalllabguide_500.pdf

Quest Title	Find It, Fix It
Mission	Identify nine instances of safety infractions. Assist lab personnel to fix the problems and resolve the safety infractions. This Quest includes review of potential biological, chemical, and physical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Safe use of compressed gas cylinders, the chemical fume hood, hazardous waste accumulation area, ultraviolet light, and electrical equipment; and • Common safety signage found in a lab setting.
Before the Lesson	This Quest requires the student to find and fix potential safety issues. Finding and fixing the items may require a team approach.
Lesson Activity	The infractions, as highlighted by the wrench icon, can be found in four different locations in the lab suite. Three infractions are found in the Main Lab. One is at the second door to the Main Lab. Three are in the Equipment Room and two are in the Tissue Culture Lab. Make note of the infractions as you progress through the Quest.
Discussion	Q: What were the nine infractions, why did they need to get fixed, and how were they remedied? A: - Main Lab: Mai stopped working at the chemical fume hood when she realized the inspection tag was out of date. - Main Lab: Sara made sure that each of the compressed gas cylinders was properly chained to the bench top using a safety strap. - Main Lab: Alice reattached the hazardous waste tag to the correct container in the hazardous waste accumulation area. - Second door to the Main Lab: Ensure that one Biosafety Level 2 sign is used to communicate the biological hazards in the lab instead of many signs that repeat the same information and make it difficult to determine safe work practices. - Equipment Room: The sign on the refrigerator is fixed such that it reads “No Food and Drink Allowed” in keeping with the lab rules of no food or drink allowed in the lab. - Equipment Room: Jamaal receives the necessary personal protective equipment (cold gloves, face shield, impact glasses) to safely work with samples from the liquid nitrogen freezer.

Quest Title	**Find It, Fix It**
	- Equipment Room: A sign is placed over the frayed electrical cord to ensure no one uses it until Jamaal is able to get it fixed. - Tissue Culture Lab: Food and drink are not stored or consumed at the laboratory bench. Grant is reminded to eat his snacks outside of the laboratory in the Break Room. - Tissue Culture Lab: Ling receives the necessary personal protective equipment (face shield and impact glasses) to protect her face and eyes from the ultraviolet light emitted from the transilluminator.
Evaluation	Q: What should a student do if they see a potential safety hazard in the laboratory? A: Report the potential problem to a teacher or administrator as soon as possible. Students should not feel obligated to fix these problems on their own.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 25 minutes Discussion: 15 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Chemical Fume Hood • Compressed Gas Cylinder • Hazardous Waste Accumulation Area • Biosafety Level 2 • Refrigerator • Liquid Nitrogen Freezer • Cryogenic Liquids • Face Shield • Hazardous Light • Transilluminator Box

Quest Title	**Waste Without Haste – Needle Disposal**
Mission	Assist an alien character to properly dispose of a sharp This Quest covers waste management.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Management of waste generated in a lab, specifically a sharp in the form of a needle.
Before the Lesson	This Quest is similar to the Waste Without Haste – Petri dish disposal Quest. This time, the Quest deals with a sharp.
Lesson Activity	Encourage students to try to dispose of the needle in different waste receptacles throughout the lab and to read the associated text messages when the incorrect waste receptacles are selected.
Discussion	This Quest helps students to become familiar with the concept that most things in the lab environment cannot be disposed of in the regular trash. Students and teachers should stop and think about everything they need to throw away – acknowledging that they may not know what the item is or where to properly dispose of it – and recognize the need to research safer disposal options.
Evaluation	Identify items in the laboratory and determine where they should be properly disposed of to minimize harm to people and the environment. Examples include everyday items (e.g., paper), laboratory equipment, and biological materials (e.g., the dissected worm from biology class).
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Laboratory Waste Management • Sharp • Sharps Container The EPA has several publications about lab waste management. We recommend the small lab guide: http://www.epa.gov/sbo/pdfs/smalllabguide_500.pdf

Quest Title	Blow It Up
Mission	Watch what can happen when dry ice is incorrectly packaged for shipment. This Quest discusses physical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Limitations of shipping hazardous materials; and • Limitations of packaging dry ice.
Before the Lesson	This Quest is short, but that should not detract from its serious message.
Lesson Activity	Be prepared to pay close attention to the video portion of this Quest.
Discussion	Q: What is dry ice? A: Dry ice is solidified carbon dioxide. When dry ice warms, it changes from a solidified state to a gaseous state. This gas will build inside a sealed container and without a venting device, will violently explode. Q: Who is responsible for packaging, shipping and handling biological materials? A: A worker must have the proper, certified training based on the IATA (International Air Transport Association) and the DOT (Department of Transportation) regulations. Shipping hazardous materials or Dangerous Goods (biological substances, chemicals, or radioactive materials) within and outside of the United States is subject to a variety of government regulations and airline industry and ground carriers' requirements.
Evaluation	Q: What happened in this Quest? A: Dry ice was used to pack materials. The shipping container was sealed. Pressure inside the container built up and the container exploded.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook:

	• Dry Ice • Cryogenic Liquids

Quest Title	**Blender Bender**
Mission	Assist a Principal Investigator and alien character to safely blend a biological sample. This Quest concerns biological hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Response to a splash to an eye; • Bloodborne pathogens; • Personal Protective Equipment (PPE) use; and • Safe use of lab equipment.
Before the Lesson	Brainstorm Session: When is the best time to wear PPE? What PPE is necessary? How do you properly don, doff, adjust and wear PPE? What are the limitations of PPE?
Lesson Activity	As you progress through this Quest, make note of the sequence of events leading up to the splash to the eye.
Discussion	Q: What happened to the alien character (Fr-Ed)? What caused the incident? What could have been done to prevent this from happening? A: Fr-Ed, an alien character, suffered a biological splash to the eye while blending a biological sample on an open lab bench top. Fr-Ed should not have handled the biological sample because he did not receive bloodborne pathogen training. To avoid a splash, the blender should have been used in a biological safety cabinet, in the Tissue Culture Lab. As a consequence of this exposure, Fr-Ed had to use the emergency eyewash for fifteen minutes and visit Medical Services office to report the accident and receive treatment. By using proper protective equipment and safe laboratory practices, he could have avoided this accident and splash to the eye.
Evaluation	Q: What should you do if you receive a splash to the eye? A: Go the nearest emergency eyewash station and flush your eye(s) with water for fifteen minutes. Visit Medical Services to report the accident and receive treatment.
Estimated Maximum Time to Complete	Before the Lesson: 15 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook:

Quest Title	Blender Bender
	• Biological Safety Cabinet • Biosafety Level • Blender • Bloodborne Pathogen (BBP) • Emergency Eyewash • Eye Protection • Impact Glasses • Splash Goggles Biosafety in Microbiological and Biomedical Laboratories (BMBL) http://www.cdc.gov/od/ohs/biosfty/bmbl5/bmbl5toc.htm

Quest Title	Boxing Chemicals
Mission	Assist a Principal Investigator to store four different chemicals. This Quest concerns chemical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Safe storage of chemicals; • Chemical incompatibilities; • Material Safety Data Sheets (MSDS) as a reference tool to provide information about safe storage, handling, and use of chemicals; • Labels as a form of safety information; and • Personal Protective Equipment (PPE).
Before the Lesson	Read the labels from common household cleaning agents to pinpoint safety information about appropriate personal protective equipment to wear when using the chemical and appropriate storage locations. Go online to the Internet and look for the Material Safety Data Sheet for the household cleaning agent. We suggest going to the manufacturer's website.
Lesson Activity	This Quest incorporates options for chemical storage. Depending on the option selected, a different ending will result. Students should be encouraged to try different endings.
Discussion	Q: What caused the chemicals to box each other? A: Chemical incompatibilities. The boxing ring analogy emphasized the facts of the science of chemistry, that is, not all chemicals are compatible with each other and cause potentially violent reactions when mixed together. In this Quest, nitric acid was incompatible with all the other chemicals. Acids and bases are incompatible and corrosives are incompatible with flammables. Only when the chemical was stored with similar chemicals was it "happy."
Evaluation	Q: What methods of hazard communication were available to you during this Quest? A: Labels for the chemical containers and MSDS for the chemicals communicated necessary PPE to wear when handling these chemicals and the type of chemical storage cabinet to use for safe storage of the chemical.
Estimated	Before the Lesson: 0 minutes

Maximum Time to Complete	Lesson Activity: 20 minutes Discussion: 15 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Latex Gloves • Nitrile Gloves • Material Safety Data Sheet • Carcinogen • Chemical Hazard Label • Chemical Hygiene Plan • Corrosive Chemical • Flammable Chemical • Labels • Oxidizer • Chemical Storage Cabinets • Reproductive and Developmental Toxins

Quest Title	**Waste Without Haste – Acid Disposal**
Mission	Assist an alien character to properly manage hazardous waste generated in the lab This Quest covers waste management.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Management of waste generated in a lab, specifically hazardous waste.
Before the Lesson	This Quest is similar to the Waste Without Haste – Petri dish disposal and Needle disposal Quests. This time, the Quest deals with hazardous chemical waste.
Lesson Activity	Petri dishes and needles can be deposited into the proper waste receptacle, whether it is a biohazard bag or a sharps container. In this instance, the hazardous waste must be added to the hazardous waste accumulation area by trained personnel.
Discussion	Students should know where hazardous waste is managed in the laboratory, but are not ultimately responsible for its safe management and proper disposal.
Evaluation	Identify items in the laboratory and determine where they should be properly disposed of to minimize harm to people and the environment. Examples include everyday items (e.g., paper), laboratory equipment, and biological materials (e.g., the dissected worm from biology class).
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 10 minutes Discussion: 10 minutes
Additional Resources	Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Laboratory Waste Management • Hazardous Waste Accumulation Area

Quest Title	Slip Sliding Away
Mission	Answer Game Show questions about biological safety and slips, trips, and falls. Then, safely maneuver through an obstacle course of laboratory hazards. This Quest concerns physical hazards.
Lesson Objectives	After completing this portion of the training, the student user will have knowledge of the following: • Slips, trips, and falls; • Personal Protective Equipment (PPE); and • Safe transport of hazardous materials in the lab.
Before the Lesson	This Quest has two parts. The first takes place in the Game Show environment and the second in the laboratory suite. Students will be challenged to answer questions in the Game Show and then use the knowledge gained from the questions to safely maneuver around potential slip, trip, and fall hazards.
Lesson Activity	As students progress through this Quest, make note of how they do on the questions and how many times their avatar's "die" from too many slip, trip, and fall accidents.
Discussion	Q: Why is it important to address slips, trips and falls? A: According to the U. S. Department of Labor, slips, trips, and falls constitute the majority of general industry mishaps. This particular category of mishaps causes 15 percent of all accidental deaths and is second only to motor vehicles as a cause of fatalities.
Evaluation	Review the questions asked during this Quest. Q: What Biosafety Level is assigned to laboratories that work with microorganisms that are not known to consistently cause disease in healthy adults? A: Biosafety Level 1. Q: Slips can occur while on smooth, slick, or wet surfaces. There are other factors that can contribute to slipping. What are they? A: The slope of the surface; the momentum you build up when walking; and wearing shoes that do not provide adequate traction. Q: Which statement best describes the differences between a chemical fume hood (CFH) and a biological safety cabinet (BSC)? A: A CFH protects you from chemical vapors/splashes and a BSC

	protects you, the work, and the experiment from contamination. Q: What should you do if you see an unwanted pest in the lab? A: Contact the Pest Management Service. Q: To help avoid slips, you should make sure that the heels of your shoes are in good condition and are as low and wide as possible. A: True. Q: Which of the following is not a know hazard associated with cryogenic liquids, such as liquid nitrogen, used in the liquid nitrogen freezer? A: Extreme heat. Q: Who is responsible for ensure that individuals are responsible for their own conduct, safety, and practices and procedures in the lab? A: Each laboratory worker. Q: To prevent trips in the lab, you should always watch where you're going to maintain a tidy workplace. You should also practice the following: A: Store equipment, boxes and containers out of aisles or hallways; secure electrical cords; and heed wet floor signage posted by Custodial Services. Q: If you had to retrieve a sample from the liquid nitrogen freezer, what personal protective equipment should you wear? A: Lab coat, impact glasses, a face shield, and cold gloves. Q: What Biosafety Level is assigned to laboratories that work with microorganisms that are indigenous or exotic, have potential for aerosol transmission, and may have serious or lethal consequences in exposed adults? A: Biosafety Level 3.
Estimated Maximum Time to Complete	Before the Lesson: 5 minutes Lesson Activity: 20 minutes Discussion: 15 minutes
Additional Resources	To learn more: http://www.osha.gov/SLTC/teenworkers/hazards_slips.html. Review and incorporate the following terms into the Discussion section. These terms can be found in the Laboratory Notebook: • Biosafety Levels 1, 2, 3, and 4 • Transport of Hazardous Materials